

CLAIMS

The invention is claimed as follows:

1. A light-emitting device comprising:
a light-emitting device main body having a light output surface and transferred,
5 and
a transparent electrode formed in a size larger than a size of the light output surface so as to cover the light output surface and connected directly to a whole area of the light output surface.
- 10 2. The light-emitting device as set forth in claim 1, wherein
the transparent electrode provides direct connection between a wiring for supplying electric power to the light-emitting device main body.
3. A light-emitting device comprising:
15 a light-emitting device main body having a light output surface, and
a transparent electrode formed in a size larger than a size of the light output surface so as to cover the light output surface, wherein
the light-emitting device main body is provided in the form of a chip that includes a plurality of semiconductor layers, and wherein
20 the transparent electrode is connected directly to a whole area of the light output surface and connected to one or more side surfaces of one or more of the semiconductor layers including the light output surface.
4. The light-emitting device as set forth in claim 3, wherein
25 the transparent electrode is connected to side surfaces of one or more of the semiconductor layers including the light output surface through a contact layer.
5. The light-emitting device as set forth in claim 3, wherein
the refractive index of the transparent electrode is lower than the refractive
30 index of the semiconductor layer including the light output surface and is higher than the refractive index of a resin layer provided on the upper side of an transparent electrode.

6. The light-emitting device as set forth in claim 3, wherein
the transparent electrode is formed by coating the light output surface with a
paste containing one or more conductive particulates dispersed in a light-transmitting
5 resin.

7. The light-emitting device as set forth in claim 6, wherein
the conductive particulates scatter light emitted from the light output surface
and diffuse the light from the transparent electrode to an exterior of the device.
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8. The light-emitting device as set forth in claim 6, wherein
the conductive particulates include indium tin oxide.

9. A light-emitting device comprising:
15 a light-emitting device main body having a light output surface, and
a transparent electrode formed in a size larger than a size of the light output
surface so as to cover the light output surface and connected directly to a whole area of
the light output surface.

10. A light-emitting apparatus comprising:
20 a plurality of light-emitting device main bodies each having a light output
surface and transferred, and
a transparent electrode formed to be larger in size than the light output surfaces
so as to cover the light output surfaces and connected directly to a whole areas of the
25 light output surfaces.

11. The light-emitting apparatus as set forth in claim 10, wherein
the transparent electrode is formed collectively on the light output surfaces of
the plurality of light-emitting device main bodies.
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12. The light-emitting apparatus as set forth in claim 10, wherein

the transparent electrode is formed by coating the light output surfaces with a paste containing one or more conductive particulates dispersed in a light-transmitting resin.

5 13. The light-emitting apparatus as set forth in claim 12, wherein
the conductive particulates scatter light emitted from the light output surfaces and diffuse the light from the transparent electrode to an exterior of the apparatus.

10 14. An image display apparatus comprising an image display surface
formed by arranging a plurality of light-emitting devices on an apparatus substrate, each of the light-emitting devices comprising a light-emitting device main body having a light output surface and transferred, and a transparent electrode formed in a size larger than a size of the light output surface so as to cover the light output surface and connected directly to whole area of the light output surface.

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15. A method of manufacturing a light-emitting device, the method comprising the steps of:

transferring a light-emitting device main body having a light output surface onto a resin portion so as to expose the light output surface;

20 forming a resist film on the light output surface and the surface of the resin portion;

providing the resist film with an opening portion larger in size than the light output surface so that the opening portion fronts on the light output surface; and

25 forming a transparent electrode in the opening portion so that the transparent electrode is connected directly to an area of the light output surface.

16. The method of manufacturing a light-emitting device as set forth in claim 15, wherein

30 the opening portion is so formed as to front on a wiring for supplying electric power to the light-emitting device main body, and the light output surface and the wiring are connected directly to each other through the transparent electrode.

17. A method of manufacturing a light-emitting device, the method comprising the steps of:

forming a resist film on a light output surface of a light-emitting device main body;

5 providing the resist film with an opening portion larger in size than the light output surface so that the opening portion fronts on the light output surface; and

forming a transparent electrode in the opening portion so that the transparent electrode is connected directly to a whole area of the light output surface.

10 18. A method of manufacturing an image display apparatus, the method comprising the steps of:

transferring a plurality of light-emitting device main bodies each having a light output surface onto a resin portion so as to expose the light output surfaces;

15 forming a resist film on the light output surfaces and the surface of the resin portion;

providing the resist film with an opening portion larger in size than the light output surfaces so that the opening portion fronts on the light output surfaces; and

forming a transparent electrode in the opening portion so that the transparent electrode is connected directly to an area of the light output surfaces.

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19. The method of manufacturing an image display apparatus as set forth in claim 18, wherein

the opening portion is so formed as to front on a wiring for supplying electric power to the plurality of light-emitting device main bodies, and the light output surfaces and the wiring are connected to each other collectively through the transparent electrode.

20. A light-emitting apparatus comprising:

30 a light-emitting device comprising a light-emitting device main body having a light output surface and transferred, and a contact metal formed on the light output surface;

a wiring layer formed outside the region of the light output surface; and

a transparent electrode so formed as to cover the contact metal and the wiring layer.

21. The light-emitting apparatus as set forth in claim 20, wherein the
5 transparent electrode is formed in a size larger than a size of the light output surface
and connected directly to a whole area of the light output surface.

22. The light-emitting apparatus as set forth in claim 20, wherein the
surface, making contact with the transparent electrode, of the contact metal is formed
10 of a noble metal.

23. The light-emitting apparatus as set forth in claim 20, wherein the
surface, making contact with the transparent electrode, of the wiring layer is formed of
a noble metal.

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24. The light-emitting apparatus as set forth in claim 20, further comprising
a protective resin layer so formed as to cover the transparent electrode.

25. The light-emitting apparatus as set forth in claim 24, further comprising
20 a diffusion preventive layer for preventing mutual diffusion of a component of the
protective resin layer and a component of the transparent electrode, between the
protective resin layer and the transparent electrode.

26. A method of manufacturing a light-emitting apparatus the method
25 comprising the steps of:

transferring a light-emitting device main body having a light output surface
onto a resin portion so as to expose the light output surface;

forming an electrode separation wall on the surface of the resin portion;

providing the electrode separation wall with an opening portion larger in size
30 than the light output surface so that the opening portion fronts on the light output
surface;

forming a wiring layer on a surface of the resin portion in an inside of the opening portion; and

forming a transparent electrode in the opening portion so that the transparent electrode is connected directly to a contact metal formed on the light output surface
5 and to the wiring layer.

27. The method of manufacturing a light-emitting apparatus as set forth in claim 26, wherein the wiring layer is formed outside the region of the light output surface.
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28. The method of manufacturing a light-emitting apparatus as set forth in claim 26, wherein after a transparent electrode material is so applied as to cover the opening portion and the electrode separation wall and is hardened, the transparent electrode material is polished to expose the surface of the electrode separation wall,
15 thereby forming the transparent electrode.

29. The method of manufacturing a light-emitting apparatus as set forth in claim 26, wherein the transparent electrode is formed by jetting a transparent electrode material to the opening portion by an ink jet technique, and hardening the transparent
20 electrode material.

30. The method of manufacturing a light-emitting apparatus as set forth in claim 26, wherein the transparent electrode is formed by applying a transparent electrode material to the opening portion by screen printing, and hardening the
25 transparent electrode material.

31. The method of manufacturing a light-emitting apparatus as set forth in claim 26, wherein a plurality of the light-emitting device main bodies are transferred onto the resin portion, and the transparent electrode is formed collectively so as to
30 cover contact metals formed on the light output surfaces of a plurality of the light-emitting devices.

32. The method of manufacturing a light-emitting apparatus as set forth in claim 26, wherein the wiring layer is formed by forming a metallic layer in an inside of the opening portion, and thereafter laminating a noble metal layer on the metallic layer.

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33. The method of manufacturing a light-emitting apparatus as set forth in claim 26, further comprising a step of forming a protective resin layer for protecting the transparent electrode, so as to cover the transparent electrode.

10 34. The method of manufacturing a light-emitting apparatus as set forth in claim 33, further comprising a step of forming a diffusion preventive layer for preventing mutual diffusion of a component of the protective resin layer and a component of the transparent electrode, on the surface of the transparent electrode.

15 35. An image display apparatus comprising an image display surface formed by arranging a plurality of light-emitting apparatuses on an apparatus substrate, each of the light-emitting apparatuses comprising a plurality of light-emitting devices each of which comprises a light-emitting device main body having light output surface and transferred, and a contact metal formed on the light output surface; a wiring layer
20 formed outside the regions of the light output surfaces; and a transparent electrode so formed as to cover the contact metals and the wiring layer.

36. A method of manufacturing an image display apparatus, comprising the steps of:

25 transferring a plurality of light-emitting device main bodies each having a light output surface onto a resin portion so as to expose the light output surfaces;

forming an electrode separation wall on a surface of the resin portion;

providing the electrode separation wall with an opening portion larger in size than the light output surfaces so that the opening portion fronts on the light output
30 surfaces;

forming a wiring layer on a surface of the resin portion in an inside of the opening portion; and

forming a transparent electrode in the opening portion so that the transparent electrode is connected directly to contact metals formed on the light output surfaces and to the wiring layer.